

**A WIRELESS MOBILE PHONE WITH AUTHENTICATED MODE OF
OPERATION INCLUDING PHOTO BASED AUTHENTICATION
RELATED APPLICATION**

The present invention claims priority to provisional application number
5 60/457,801, filed March 28, 2003, entitled "A Wireless Mobile Phone With
Authenticated Mode Of Operation Including Photo Based Authentication", and
incorporated in its entirety by reference.

FIELD OF THE INVENTION

The present invention relates to the field of wireless communication. More
10 specifically, the present invention is related to a wireless mobile phone having an
authenticated mode of operation available only to an authenticated user, in
particular, a user authenticated via a photograph of the user's.

BACKGROUND OF THE INVENTION

Advances in microprocessor and telecommunication technology have led
15 to wide spread deployment and adoption of mobile devices, such as wireless
mobile phones. For wireless mobile phones, in addition to wireless telephony,
the late models are often equipped with advanced capabilities, such as calendar,
address book, access to the World Wide Web (WWW), emails, and so forth.

Much of these functionalities are designed to increase the productivity of
20 business users. As a result, it is not surprising that business users constitute a
major user segment of wireless mobile phones, especially for the high-end
function rich models. Increasingly, more business data, such as business contact
information, business plans, sales/marketing strategies, financial reports, and so
forth, are being stored on wireless mobile phones.

25 However, unlike personal computers or other computing devices, where
user authentication, through e.g. user log-in, are routinely provided with virtually
all operating systems, few if any operating systems of wireless mobile phones
provide means to authenticate users. As a result, under the prior art, wireless
mobile phones are at risk of unauthorized usage, as well as data being
30 compromised by unauthorized accesses.

Thus, it will be desirable if protection against unauthorized access of user
data and/or usage of wireless mobile phones can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described by way of exemplary embodiments, but not limitations, illustrated in the accompanying drawings in which like references denote similar elements, and in which:

5 **Figure 1** illustrates a front view of a wireless mobile phone incorporated with the teachings of the present invention, in accordance with one embodiment;

Figures 2-3 illustrate two architectural views of the wireless mobile phone of **Fig. 1**, in accordance with one embodiment;

Figures 4a-4b illustrate the operational flow of the relevant aspects of the operating logic of **Fig. 3**, in accordance with one embodiment;

10 **Figure 5** illustrates a front view of another wireless mobile phone incorporated with the teachings of the present invention, in accordance with an alternate embodiment;

Figures 6a-6b illustrate two perspective views of another wireless mobile phone incorporated with the teachings of the present invention, in accordance with yet another embodiment;

Figures 7a-7b illustrate a front view and a side view of another wireless mobile incorporated with another aspect of the teachings of the present invention, in accordance with yet another embodiment; and

20 **Figures 8a-8b** illustrate a front view and a back view of the identity card of **Fig. 7b** in further detail, in accordance with one embodiment.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

 The present invention includes, but not limit to, a wireless mobile phone having an authenticated mode of operation, available only to an authenticated user, in particular, a user authenticated by a photograph of the user.

25 Parts of the description will be presented in terms commonly employed by those skilled in the art to convey the substance of their work to others skilled in the art. The term "wireless mobile phone" as used herein (in the specification and in the claims) refers to the class of telephone devices equipped to enable a user to make and receive calls wirelessly, notwithstanding the user's movement, as long as the user is within the communication reach of a service or base station of a wireless network service provider. Unless specifically excluded, the term

"wireless mobile phone" is to include the analog subclass as well as the digital subclass (of all signaling protocols).

The terms "photograph" and "photo" as used herein are synonymous, and are used interchangeably. Unless the context specifically delineates the
5 "photograph" or "photo" to a particular manifestation, the terms are to include the physical manifestation of the photograph/photo, and/or the data structure/organization incarnation holding the data of the photograph/photo.

In the following description, various aspects of the present invention will be described. However, it will be apparent to those skilled in the art that the present
10 invention may be practiced with only some or all aspects of the present invention. For purposes of explanation, specific numbers, materials and configurations are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced without the specific details. In other instances, well-known
15 features are omitted or simplified in order not to obscure the present invention.

Various operations will be described as multiple discrete steps in turn, in a manner that is most helpful in understanding the present invention, however, the order of description should not be construed as to imply that these operations are necessarily order dependent. In particular, these operations need not be
20 performed in the order of presentation.

The phrase "in one embodiment" is used repeatedly. The phrase generally does not refer to the same embodiment, however, it may. The terms "comprising", "having" and "including" are synonymous, unless the context dictates otherwise.

25 Referring now to **Figures 1 and 3a-3b**, wherein a front view and two architecture (internal component) views of a wireless mobile phone of the present invention, in accordance with one embodiment, are shown. As illustrated, wireless mobile phone **100** of the present invention (hereinafter, simply phone **100**) is advantageously provided with operating logic **240** equipped in particular
30 with security function **242**, to operate phone **100** in at least an unauthenticated mode of operation and an authenticated mode of operation.

While operating in the unauthenticated mode of operation, i.e. without having the user authenticated, operating logic **240** makes available only a limited

or reduced set of functions, whereas under the authenticated mode of operation, i.e. having the user authenticated, operating logic **240** makes available a more expanded or the entire set of functions.

5 The exact constitution of the limited/reduced set of functions and the expanded/full set of functions is application dependent, which may vary from embodiments to embodiments. In one embodiment, the limited/reduced set of functions include only the ability to make an emergency call, such as a 911 call, otherwise, no other functions, including but not limited to making other calls, accessing calendar, email, text messaging, viewing and/or storing documents,
10 normal taking of pictures/photographs, and so forth, are permitted. These other functions are available only under the authenticated mode.

In another embodiment, the limited/reduced set of functions may effectively be a null function set, excluding even the ability to make an emergency call, except for notification of the unauthenticated status of the user, and perhaps,
15 inviting the user to authenticate himself/herself, by e.g. allowing a photograph of the user to be captured in real time.

In various embodiments, in addition to the above described unauthenticated and authenticated modes of operation, operating logic **240** further supports a provisioning mode of operation, under which phone **100** is
20 initially provisioned. Under the initial provisioning mode, conventional provisioning, such as configuring phone **100** for a particular wireless carrier, a particular subscriber and so forth, may be performed. Entry into the initial provisioning mode may be effectuated in any one of a number of conventional approaches.

25 Continue to refer to **Figures 1** and **3a-3b**, for the illustrated embodiment, phone **100** is further advantageously equipped with camera **132** (including lens **134**) to facilitate taking of photographs (while operating in the authenticated mode). However, in addition to its conventional use for taking photographs, operating logic **240**, or more specifically, security function **242**, is endowed to
30 authenticate a user through a photograph of the user (prior to operating phone **100** in the authenticated mode).

In particular, as will be described in more detail below, operating logic **240**, in general, is equipped to establish a reference photograph of a user for

authentication purpose, and automatically invokes camera **132** to capture a photograph of the user real time, during power on or reset. Further, security function **242** is endowed to use the reference and the real time captured photographs of the user to authenticate the user, and determine whether to
5 continue to operate phone **100** in an unauthenticated mode, or operate phone **100** in an authenticated mode.

In other words, under the present invention, operating logic **240** operates phone **100** in the authenticated mode, and makes available the expanded/full set of functionalities, only if the user has been authenticated by his/her photo,
10 otherwise, phone **100** is operated in the unauthenticated mode with only a limited/reduced set of functionalities (except in the initial provisioning mode).

For the embodiment, operating logic **240**, more specifically, security function **242**, also supports the taking of a photograph of the user, and its saving as a reference for subsequent analysis of a taken photograph to authenticate a
15 user, before operating phone **100** in the authenticated mode.

In various embodiments, the saving of the reference photograph is also supported under a special configuration mode, while operating in the authenticated mode. Entry into the configuration mode (while operating in the authenticated mode) may also be effectuated in any one of a number of
20 conventional means.

Continuing to refer to **Fig. 1** and **3a-3b**, additionally, phone **100** includes conventional wireless telephony elements, including power switch **122**, power **222**, audio communication elements, such as ear speaker **112** and microphone **114**, and non-audio communication elements, such as input key pad **102** having
25 a number of alphanumeric input keys and display **108**. Further, the non-audio input elements may further include scroll button **105**, selection buttons **106**, and "talk" and "end talk" buttons **104**. These elements are disposed on various external surfaces of body **116**.

As illustrated in **Fig. 3a**, upon depression by a user (optionally, for a predetermined duration), while phone **100** is in a powered down or lower power state, power switch **122** couples power **222** to camera **132** and other components **202-212**. Likewise, upon depression by a user (optionally, for a predetermined duration), while phone **100** is in powered up state, power switch **122** cuts off or
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reduces power **222** to all or selected ones of camera **132** and other components **202-212**.

Externally, phone **100** may also include antenna **110**. Keys of key pad **102** may be surrounded by, or otherwise include illuminable light emitting diodes (LED) in their backgrounds. For the purpose of the present specification, the terms "button" and "key" may be considered synonymous, unless the context clearly indicates otherwise.

Internally, in addition to processor **202** and DSP **204**, phone **100** also includes non-volatile memory **206**, general purpose input/output (GPIO) interface **208**, and transmit/receive (TX/RX) **212**, coupled to each other, processor **202** and DSP **204**, via bus **214**, and disposed on a circuit board **220**.

Except for the novel manner that many of these elements, such as processor **202**, DSP **204** and so forth, are used in support of making the expanded/full set of functionalities available only to an authenticated user, the enumerated elements otherwise perform their conventional functions known in the art.

Non-volatile memory **206** is employed to store programming instructions and optionally, working data, including operating logic **240** and its security function **242**. Working data may include callee/messaging party or parties (e.g. their phone numbers or IP addresses) with whom user may communicate. Working data may include the reference and input photographs of the user.

Processor **202**, assisted by DSP **204**, is employed to operate phone **100**, executing operating logic **240**, including security function **242**.

Keys of key pad **102** may be employed to enter alphanumeric data, including entering a sequence of alphanumeric data for the phone number or address of a "callee". Selected sequence of the keys (such as "**#") may also be employed to denote a user instruction to return to the unauthenticated mode of operation, if entered while operating in the authenticated mode of operation, or to return to the authenticated mode of operation, if entered while operating in the unauthenticated mode of operation (provided the user is authenticated).

Scroll key **105** and companion selection keys **106** may be employed to scroll and select various options or list items of various menu options or selection lists, including scrolling and selecting list items presented for user interactions to

verify the user's wellness. For the embodiment, scroll key **105** may be selected in one of two positions, an "up" position or a "down" position for scrolling a selection list in an "up" direction and a "down" direction respectively. Similarly, scroll and selection keys **105/106** may also be employed to select a menu item to convey a user instruction to return to the unauthenticated mode, if the selection is made while operating in the authenticated mode, or to return to the authenticated mode, if the selection is made while operating in the unauthenticated mode (provided the user is authenticated).

GPIO 208 may be employed to generate input signals, such as a corresponding "alphanumeric" signal in response to a user selection of one of the keys of key pad **102**, a "scroll" signal" (or more specifically, a "scroll up" or a "scroll down" signals) in response to a user selection of scroll key **105**, a "selection" signal in response to a user selection of select button **106**, and so forth.

TX/RX 212 may be employed to transmit and receive communication signals for a call and/or a text message. **TX/RX 212** may be a radio frequency transceiver, and support one or more of any of the known signaling protocols, including but are not limited to CDMA, TDMA, GSM, and so forth.

The constitutions of these elements are known, and will not be further described.

As to operating logic **240**, including security function **242**, it may be implemented in the assembly or machine instructions of processor **202**, or a high level language that can be compiled into these assembly or machine languages. In alternate embodiments, all or portions of operating logic **240**, including security function **242** may be implemented in firmware and/or hardware.

Accordingly, except for the enhancements provided, phone **100** otherwise represents a broad range of wireless mobile phones, including both the analog as well as the digital types (of all signaling protocols), substantially rectangular uni-body as illustrated, or curved uni-body, as well as multi-portions, such as "flip phones" to be illustrated later.

Figure 4 illustrates the operational flow of the relevant aspects of operating logic **240**, in accordance with one embodiment. As illustrated, on start up/reset (such as depression of power on/off button **122** for the required

predetermined duration by a user), operating logic **240** enables phone **100** to operate in the earlier described unauthenticated mode, making available only a limited/reduced set of functionalities, block **402**. Thereafter, operating logic **240** waits for additional user input, block **404**.

5 Recall from earlier description, upon depression by a user, while phone **100** is in powered down or low power state, power switch **122** couples power to camera **122** and other components **202-212** of phone **100**. For the embodiment, on power on/reset, operating logic **230** causes camera **132** to automatically take a photograph of the objects in view. Resultantly, a photograph of an authorized
10 user who is aware of the authentication requirement, and have properly position his/her face in front of the camera, would have a photograph of the user taken or captured in real time, for authentication.

Accordingly, under the present invention, photograph based authentication is seamless integrated with the power on/reset process.

15 While typically, the authentication process employs photographs that are front views of a user's face, in alternate embodiments, the present invention may be practiced with the authentication process employing photographs that are side views of a user's face, or other views. Further, the present invention may be practiced with authenticating against any arbitrary photograph, a photograph of
20 the user's hand, feet, a ring, a watch, a spouse or child's picture, and so forth. The random selection of articles/objects, in particular, an article/object that is "unique", and is almost always in possession by the user only, may be just as secure as authenticating against a photograph of the user's face.

Continuing to refer to **Fig. 4**, on receipt of inputs, operating logic **240**
25 determines if the input is a photograph captured by camera **132** in real time (more specifically, by DSP **204**, after it processes the signals output by camera **132** into a photograph), block **406**.

If the user input is photograph, operating logic **240** (or more specifically, security function **242**) further determines if phone **100** is operating in the
30 unauthenticated mode, within the authenticated mode (including whether it is within the configuration mode of the authenticated mode), or the initial provisioning mode, block **407**.

If phone **100** is determined to be operating in the authenticated mode, the processing is turned over to a camera function (not shown), which handles the photograph in an application dependent manner, block **408**. In other words, the user is using camera **132** for its primary purpose, taking photographs/pictures for the user.

If phone **100** is determined to be operating in the configuration mode within the authenticated mode, or the initial provisioning mode, operating logic **240** (or more specifically, security function **242**) saves the captured photograph as a reference photograph for future user authentication, block **408**.

If phone **100** is determined to be operating in the unauthenticated mode, operating logic **240** (or more specifically, security function **242**) initiates the photograph based authentication process, authenticating the user by comparing the real time captured photograph, against the previously saved reference photograph, block **409**.

If the photograph does not substantially match the previously saved reference photograph, block **410**, operating logic **240** (or more specifically, security function **242**) reports the authentication failure, block **412**, and continues to operate phone **100** in the unauthenticated mode at block **404**.

However, if the inputted photograph substantially matches the previously saved reference photograph, block **410**, operating logic **240** (or more specifically, security function **242**) enables phone **100** to operate in the authenticated mode, block **414**. Thereafter, operating logic **240** continues operation at block **404**.

The precision level at which a real time captured photograph is to be considered substantially matching with a reference photograph is application dependent. Preferably, different user selectable precision levels are offered. As with other user selectable options, the selection may be facilitated in any one of a number of known user selection techniques.

Back at block **408**, if the input is determined not to be photograph input, operating logic **240** determines if the input is a user instruction to return to the unauthenticated mode of operation (e.g. a user selecting or inputting such command using alphanumeric keys **102** and/or scroll/select keys **105** and **106** while operating in an authenticated mode of operation), block **416**.

If the input is determined to be a user instruction to return to the unauthenticated mode of operation, operating logic **240** (or more specifically, security function **242**) returns phone **100** to operate in the unauthenticated mode, block **418**. Thereafter, operating logic **240** continues operation at block **404**.

5 In one embodiment, before exiting to the unauthenticated mode, operating logic **240** (or more specifically, security function **242**) causes a user selectable "resume" (i.e. re-authentication) option to be rendered on display **108**. Selection of the option is processed as if phone **100** is being powered on or reset. That is, operating logic **240** automatically causes camera **132** to capture another
10 photograph of the objects in view for authentication purpose.

If the input is determined to be other user inputs, operating logic **240** handles the other user inputs in an application dependent manner, block **420**. In particular, if the input is a user instruction to return to the authenticated mode of operation, operating logic **240** continues operation at block **404**, and awaits for
15 another photograph input to re-authenticate the user. If the input is other conventional inputs, the inputs are processed as in the prior art. Thereafter, operating logic **240** continues operation at block **404**.

Figure 5 illustrates another embodiment of the wireless mobile phone of the present invention. More specifically, **Fig. 5** illustrates a front view of the
20 alternate embodiment. The alternate embodiment is substantially that of the embodiment of **Fig. 1**, except that phone **100** is substantially rectangular in shape, whereas phone **500** has a curved shape. Also, camera **532** is disposed at a side of the front surface of body **516** of phone **500** instead.

Figures 6a-6b illustrate yet another embodiment of the wireless mobile
25 phone of the present invention. More specifically, **Fig. 6a-6b** illustrate two perspective views of the embodiment. The embodiment is also substantially that of the embodiments of **Figs. 1** and **5**, except that phone **100** is substantially rectangular, phone **500** has a curve shaped body, whereas phone **700** has a multi-section body. The multi-section form factor includes a first section **716b**
30 and a second section **716c**, and the second section **716c** is further comprised of at least two sub-sections **716d-716e**. The first and second sections **716b-716c** may pivot towards each other as denoted by direction arrow **706a** or away from each other opposite to the direction denoted by arrow **706a**. Sub-section **716d**

may rotate relative to sub-section **716e** as denoted by the directions denoted by arrows **706b**. In other words, phone **700** may be considered as an improved version of what is commonly referred to as "flip" phones.

Similar to the earlier described embodiments, phone **700** is provided with operating logic having a security function as earlier described, and camera **732**. Except, camera **732** is disposed at a front surface of upper section **716b** of phone **700** instead.

In alternate embodiments, second section **716c** may be a uni-section, i.e. it is not further sub-divided into to relatively pivotable sub-sections.

In yet other embodiments, the reference photograph may be provided to the wireless mobile phone in a secure manner, e.g. read from an identity card, via an identity card reader additionally provided to the wireless mobile phone.

Figures 7a-7b illustrate one such embodiment. As illustrated in **Fig. 7b**, wireless mobile phone **100** is additionally endowed with an identity card reader **740**. Identity card reader **740** (optionally, assisted by a device driver additionally provided to supplement operating logic **240**) is equipped to retrieve the earlier described reference photograph from identity card **742**.

Preferably, identity card **742** has a form factor that is difficult to forge, and its issuance is governed by a secured process. Resultantly, security for wireless mobile phone **100** is further enhanced.

For the embodiment, identity card **742** comprises a smart electronic card **744** (commonly referred to as a smart card) (see **Fig. 8a-8b**), and the reference photograph is pre-stored in the embedded smart card **744**. Operating logic **240** (optionally, supplemented by a corresponding reader device driver) retrieves the reference photograph from embedded smart card **744**, on detection of the presence of identity card **742**.

In various embodiments, the reference photograph may be further protected via encryption, requiring operating logic **240** to possess the proper decryption key to recover the reference photograph after retrieval.

In yet other embodiments, the reference photograph may be further protected via an authentication protocol, requiring wireless mobile phone **100** to be equipped with the appropriate credential to authenticate itself to smart card

744, before being allowed by smart card **744** to access the pre-stored reference photograph in smart card **744**.

In yet other embodiments, the reference photograph may be imprinted on identity card **742**, and identity card reader **720** is an optical reader.

5 In yet still other embodiments, the reference photograph may be encoded via a magnetic strip disposed on a surface of identity card **742**, and identity card reader **720** is a magnetic code reader.

These are just a few example, other equivalent encoding/storing and reading/retrieving techniques may also be employed instead.

10 Conclusion and Epilogue

Thus, it can be seen from the above descriptions, a novel wireless mobile phone that can afford protection against unauthorized access to user data and/or usage of the phone has been described.

15 While the present invention has been described in terms of the foregoing embodiments, those skilled in the art will recognize that the invention is not limited to the embodiments described. The present invention can be practiced with modification and alteration within the spirit and scope of the appended claims.

20 In particular, the present invention may be practiced with employing additional and/or other means to authenticate a user.

Thus, the description is to be regarded as illustrative instead of restrictive on the present invention.